LOWER CRETACEOUS FACIES ZONES IN THE BAKONY UNIT OF HUNGARY

by

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(Received: 30th May, 1987)

Abstract

Contrasting lithology, highly varied sediment thickness and differences in the timing of pelagic sedimentation provide a tripartite division of the Bakony unit in the Neocomian. A deep basin in the Zala region, containing thick Biancone limestone and pelagic, dark marl, corresponds to the Lombardian basin of the Southern Alps. An elevated ridge (below the photic zone) with condensed sedimentation corresponds to the Trento plateau, and a contemporaneous flysch basin in the Gerecse to the Belluno trough.

Introduction

The Bakony unit is situated in the NW part of the Pannonian basin. It is bordered by the Rába and Balaton strike-slip faults, which are parts of the Periadriatic lineament system (KÁZMÉR, 1986) (Fig. 1.). It has been displaced from the Alps to its actual position by an Oligocene continental escape (KÁZMÉR and KOVÁCS, 1985). Its Lower Cretaceous formations, among others, are closely similar to those of the Southern and Eastern Alps (FÜLÖP, 1964). The marked differentiation of the Southern Alps into distinct facies zones: the Friuli platform, the Belluno trough, the Trento plateau, and the Lombardian basin with several internal swells and troughs (AUBOUIN, 1963; BOSELLINI, 1973), made us to look for similar features in the Bakony unit. This paper summarizes the results for the Lower Cretaceous (Neocomian).

Twelve published Neocomian surface and subsurface profiles, ranging from the Zala region in the west to the Gerecse region in the east are correlated with each other, emphasizing lithology and sediment thickness (Fig. 2). Their interpretation is given in the framework of a basin and ridge submarine topography.

Stratigraphy (Fig. 2)

Up to now the most important works on the Neocomian of the Bakony unit were prepared by FÜLÖP (1958, 1964), more than two decades ago. His data are still reliable and form the basis for the present paper. Further refe-

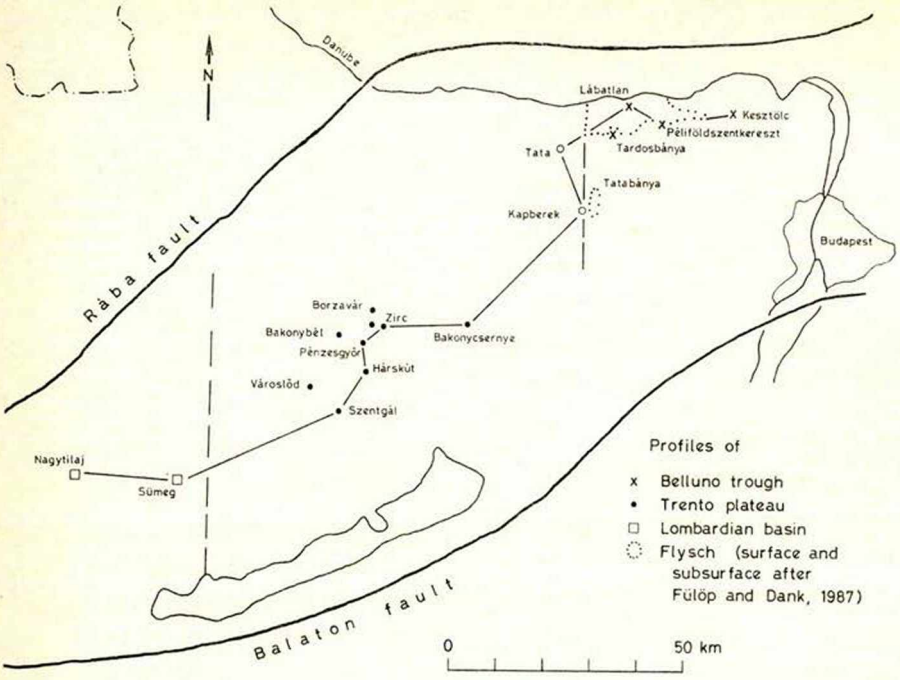

Fig. 1. Location of Lower Cretaceous profiles in the Bakony unit of Hungary. The dashed lines indicate the approximate position of basin-plateau boundaries.

rences on the lithology, biostratigraphy and sedimentology of the formations are provided by KÁZMÉR (1986).

Biancone (Tithonian – Lower Hauterivian)

(= Mogyorósdomb Limestone Formation). White, thin-bedded limestone with dark chert nodules and beds. The Berriasian – Lower Hauterivian section is about 250 m thick in a surface profile, but isoclinal folding makes this number imprecise. Its stratigraphy is based on calpionellids (TARDI–FILÁCZ, 1986), ammonoids (VÍGH in HAAS et al., 1985), and magnetostratigraphy (MÁRTON, 1986). The Tithonian – Berriasian boundary is localized in the Mogyorósdomb surface profile at Sümeg, but the other occurrence in Nagytilaj – 2 borehole is poorly dated.

Grey marl (Hauterivian – Aptian)

(= Sümeg Marl Formation). Light grey, poorly bedded marl and siltstone, without sandstone layers (FÜLÖP, 1964, HAAS et al., 1985). Thickness: 250 m in Süt – 17 borehole (no tilt correction). The rich nannoflora and planktonic foraminifer fauna and ammonite shells indicate deposition in a

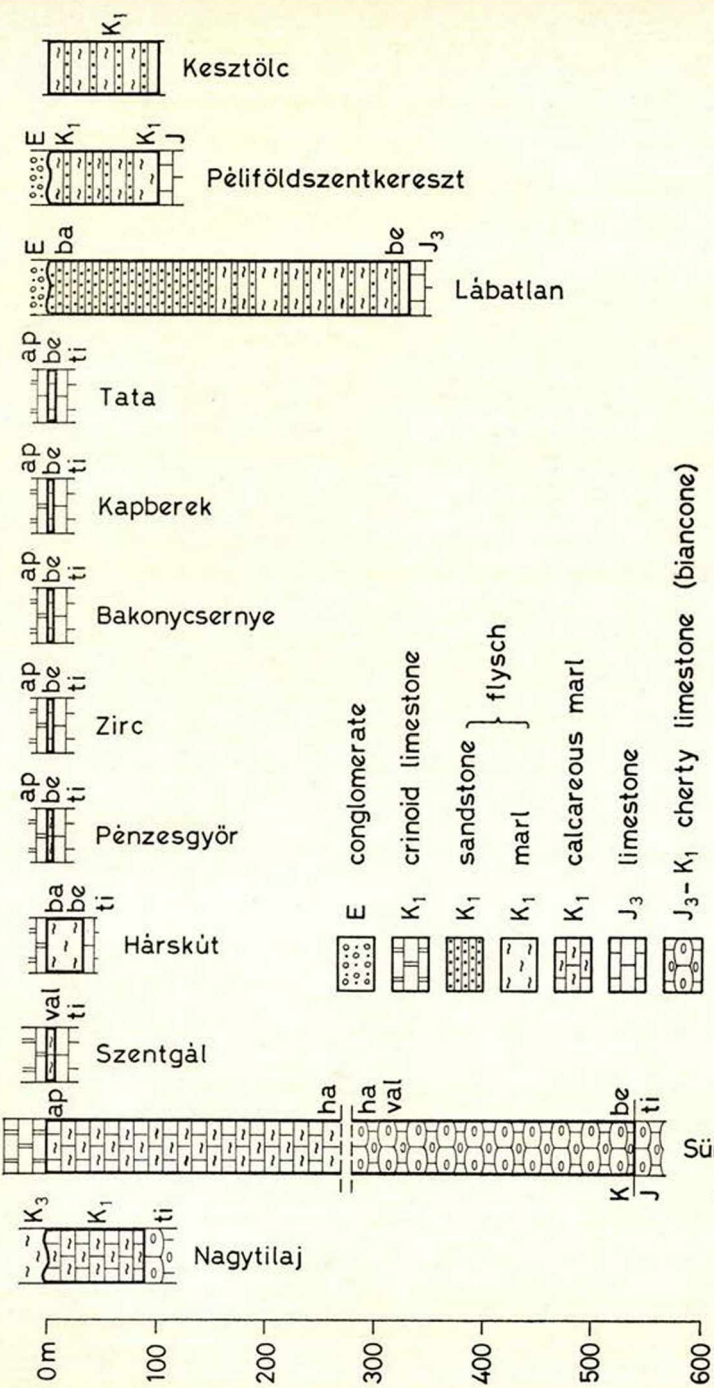

Fig. 2. Stratigraphic columns of Lower Cretaceous profiles in the Bakony unit. Thick Biancone (white cherty limestone) and dark marl sequence characterizes the Zala basin, highly condensed limestone and marl sequences occur on the Bakony plateau (including a minor trough at Hárskút). The Gerecse basin displays thick shaly and sandy flysch.

Sources: Nagytilaj – 2 borehole: Kőrössy (1987); Sümeg: Biancone (Mogyorósdomb Hill): Haas et al. (1985), marl: Süt – 17 borehole: Haas et al. (1985); Szentgál – 1 borehole: Fülöp (1964); Hárskút, Közöskút ravine (Fülöp (1964); Pénzesgyör, Somhegy: Fülöp (1964); Zirc, Bocskorhegy: Fülöp (1964); Bakonycsernye, Tűzkövesi ravine Fülöp (1964); Vértessomló, Kapberek – 43/K – I. borehole: Fülöp et al. (1965); Tata, TVG – 59 borehole: Fülöp (1976); Lábatlan, MÁK – II borehole: Fülöp (1958); Péliföldszentkereszt (drawn from a section): Gidai (1985); Kesztölc, Esztergom – 91 borehole: Nagy (1968), Rákosi (1971).

pelagic environment above aragonite compensation depth. Its subsurface exposures are known in the Sümeg region only.

A ca. 90 m thick profile in Nagytilaj – 2 borehole (1048 – 1140 m) exposes "unbedded, calcareous marl, brownish red with green spots, hard rock of conchoidal fracture. SZEPESHÁZY and DUBAY considered it Valanginian" (KŐRÖSSY, 1987, p. 116); however, lithological correlation with the Hauterivian – Aptian Sümeg Marl is more probable. Unfortunately, biostratigraphical data are not available. The marl is underlain by Biancone limestone.

Calpionellid limestone (Tithonian – Berriasian)

(= Szentivánhegy Limestone Formation). Red, compact, pelagic limestone with rich fauna: *Calpionella alpina, Globochaete* (FÜLÖP, 1976) and ammonoids (VIGH, 1984). Thin beds: thickness range from 0,2 to 2,0 m in the Berriasian. Frequent hardgrounds and dissolved ammonites occur (VIGH, 1984). Localities: Zirc, Bakonycsernye, Kapberek and Tata.

Condensed limestone beds (Berriasian to Barremian)

(Mogyorósdomb Formation and Borzavár Formation). Thin (0,3 to 2 m) limestone beds with rich ammonite fauna, and phosphate oncoids (FÜLÖP, 1964; MISZLIVECZ and POLGÁRI, 1987). Age is mostly Berriasian, rarely Valanginian and Barremian. Locally encrinite occur with well-preserved calyxes (SZÖRÉNYI, 1959).

Flysch (Berriasian to Barremian)

(Bersek Marl and Lábatlan Sandstone Formations). Upper Tithonian calpionellid limestones, covered by limonitic hardgrounds, are overlain by thin Berriasian sandstone and calcareous breccia (FÜLÖP, 1958; VÍGH, 1984). Valanginian – Lower Hauterivian grey and red marls, with graded sandstone layers follow. The upper part is Upper Hauterivian – Barremian sandstone with interbedded marls, displaying graded bedding, flute casts, trace fossils etc. The sequence is capped by Barremian chert breccia and conglomerate (FÜLÖP, 1958; CSÁSZÁR in CSÁSZÁR and HAAS, 1984). The more than 300 m thick Neocomian sequence is a prograding submarine fan: distal turbidites (Bersek Marl), proximal turbidites (Lábatlan Sandstone) and a fan channel sequence (breccia and conglomerate) (KÁZMÉR, 1987a). Rare molds of ammonites and frequent aptychi indicate deposition between aragonite and calcite compensation depths.

Crinoid limestone (Aptian)

(Tata Limestone)

Grey crinoid limestone with rare chert nodules, siliceous sponge spicules and sandy intercalations. Mostly biosparite, less biomicrite. Contains glauconite. Brachiopod and ammonite faunulas occur at the bottom, and benthic and

planktonic foraminifers above. Besides crinoid ossicles it contains much carbonate extraclasts (LELKES, 1985). It has been deposited below the photic zone, in a deep neritic to shallow bathyal environment. References: FÜLÖP (1964, 1976); HAAS et al., (1985).

Facies zones

Lithological and thickness variations (Fig. 2) make possible to recognize three facies zones in the Bakony unit of Hungary. Similar positions of Lower Liassic facies zones based on South Alpine analogues (KÁZMÉR and KOVÁCS, 1985; KÁZMÉR, 1987b) provided considerable help.

Zala basin

It covers the present-day geographic region of the North Zala hydrocarbon basin, and the westernmost part of Bakony Mts. around Sümeg. This palaeogeographic unit is based on two localities, the Nagytilaj – 2 borehole, and two boreholes (Süt – 17, Sp – 1) and a single outcrop at Sümeg.

However, the similar sequence: Upper Jurassic (to Hauterivian) biancone (more than 250 m thick), covered by more than 280 m grey, pelagic marl indicate a deep marine depositional environment above aragonite compensation depth. Conspicuous isoclinal folding (unknown elsewhere in the Bakony unit) (HAAS et al., 1985) and a surplus number of magnetostratigraphic zones (MÁRTON, 1986) in the Biancone may be due to slumps and slump folds in the sequence, indicating bathyal, slope environment. This basin shows close relationships to the Lombardian basin of the Southern Alps (KÁZMÉR and KOVÁCS, 1985).

The Sümeg locality has belonged to the neritic Bakony (=Trento) plateau in Hettangian time (KÁZMÉR, 1987b). Its shift to a basin environment before Neocomian indicate the eastward "prograding" of the Zala basin. A detailed investigation in terms of the Lombardian basin – Trento plateau border zone in the Southern Alps (CASTELLARIN, 1972) will provide more details.

Bakony plateau

Instead of the more than 500 m thick Neocomian sequence at Sümeg in the Zala basin, the Bakony plateau – extending from Szentgál to Tata – displays sequences usually less than a metre thick (but never exceeding 27 m). These beds are Biancone-like marls at the three western localities: Szentgál, Hárskút and Pénzesgyőr, and micritic limestones and encrinites in all other places. Absence of organisms which need light indicate deposition below the photic zone. Small thickness, condensation, frequent stratigraphic gaps, hardgrounds and phosphatic nodules indicate currents sweeping the plateau, preventing deposition of sediments.

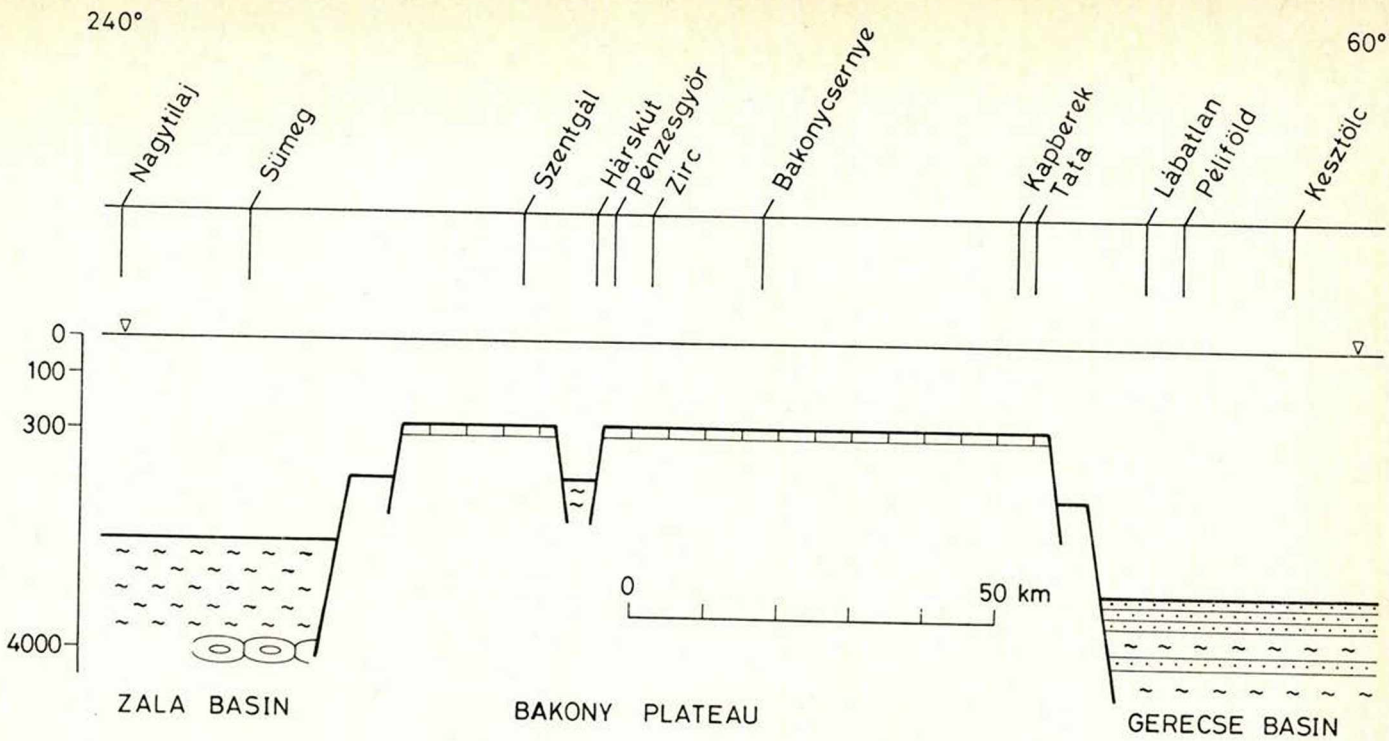

Fig. 3. Schematic palaeogeographic section of Bakony unit in Early Cretaceous (Berriasian – Barremian) time. The depth scale on the left indicates intervals only: 100 to 300 m: deep neritic; 300 to 4000 m: bathyal environment. The Zala basin contains a thick Biancone and dark marl sequence deposited above ACD. The Bakony plateau displays a highly condensed, sometimes less than 1 m thick limestone and marl sequence, with frequent gaps. The Gerecse basin is filled by a thick turbidite sequence, deposited between ACD and CCD. (Localities of Neocomian profiles are projected on a 240° – 60° line, representing the long axis of the Bakony unit.

Gerecse flysch trough

It extends from the immediate eastern neighbourhood of Tata (CSÁSZÁR and HAAS, 1979) to at least Kesztölc in the east. Following the detailed description of FÜLÖP (1958), the flysch character of the Gerecse Neocomian was recognized by CSÁSZÁR and HAAS (1979). The sediments of a prograding submarine fan (KÁZMÉR, 1987a) have been deposited in a relatively quickly subsiding basin (330 m flysch at Lábatlan vs. 0,3 m limestone at Kapberek and 6,3 m crinoid limestone at Tata (TVG – 59 borehole). The western margin was a fault, as shown by the immediate neighbourhood of the reduced Kapberek sequence and the Tatabánya flysch (data for the latter locality are available only from the pre-Cenozoic map of FÜLÖP and DANK, 1987).

Close similarities between the Gerecse flysch and the Rossfeld beds in the Northern Calcareous Alps have been known for a long time (FÜLÖP, 1958). Their relationship can be understood in the palinspastic framework of KÁZMÉR and KOVÁCS (1985), which placed the Bakony tectonic unit to the south of the Northern Calcareous Alps.

A possible palaeogeographic section emphasizing topographic differences during Neocomian time is shown in Fig. 3. The boundaries between the basins and the plateau are considered as faults, since no transition between them has been observed.

The pelagic feed-up model of pre-Neocomian basins as described by GALÁCZ et al. (1985) is valid for the Bakony plateau itself; the Zala and especially the Gerecse basins show an increase in differential subsidence.

Conclusions

The Bakony unit contains three facies zones in Hungary: the Zala basin in the west filled by 550 m carbonate and pelitic sediments; the Gerecse basin in the east with more than 330 m flysch and the Bakony ridge between them with condensed carbonate sedimentation. Their similarity with the Southern Alpine Lombardian basin, Belluno (equals to North Alpine Rossfeld) basin and Trento plateau, respectively, provides further support for the Mesozoic position of the Bakony unit within the Alps.

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